

Section II (Remarks)**Finalization of the Restriction Requirement**

The restriction requirement imposed in the March 24, 2005 Office Action against originally filed claims 1-24 has been finalized in the June 23, 2005 Office Action, in consequence of which the examiner has withdrawn claims 12-22 from consideration, with the acknowledgement that applicant is "entitled to rejoinder of the process of making claims" (2nd paragraph, page 3 of the June 23, 2005 Office Action, referring to method claims 12-17).

Accordingly, method claims 12-17 have been amended for consistency with the product claims 1-11, 23 and 24, by amendment of independent claim 12 (claims 13-17 depending directly or indirectly from claim 12) to incorporate therein the limitations introduced in amended claim 1, discussed below, to facilitate rejoinder of method claims 12-17 upon determination of the allowability of the product claims.

Amendment of Claims, Including Amendments Directed to Objection and §112 Rejections of Claims

Claims 1-4, 8-11, 23 and 24 have been amended.

Claim 1 has been amended to recite the abrasive powder as being composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium, with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%. Such limitation is consistent with claims 5 and 7 as originally filed in the application, and is supported by the examples of the application, e.g., Examples 1-5 (Table 1 at page 17 of the application, setting forth compositions having amounts of silicon that are 0.7 wt% and higher) and Example 8 (Table 5 at page 30 of the application, in which the composition contains 0.01 wt% titanium and 0.83 wt% silicon).

Dependent claims claims 2-4 and 9-11 have been amended for consistency with claim 1. Independent claims 23 and 24 have been amended correspondingly to claim 1.

Claim 4 has been amended to recite a specific composition of the invention in which the inorganic metal powder contains at least one of boron and aluminum, in amounts of not more than 1.5 wt% boron and not more than 0.1 wt% aluminum, consistent with claims 5 and 7 as originally filed.

In response to the §112 rejection of claim 8 as lacking antecedent basis for "the tap density," claim 8 has been amended herein to recite that "the metal powder has a tap density in a range of from 4.3 g/cm³ to 4.8 g/cm³ inclusive."

In response to the objection to claim 11 as failing to further limit the subject matter of a previous claim, claim 11 has been amended to depend from claim 10, and to further specify the substance providing fluidity and moisture absorption resistance as "a material selected from the group consisting of stearic acid and anhydrous silica."

Claim 12 (withdrawn) has been amended to accommodate rejoinder thereof under the provisions of MPEP §821.04, so that claim 12 now recites that "the metal contains at least one of boron, aluminum and titanium, with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%.

In response to the rejection of claims 23 and 24 under §112, second paragraph for reciting the term "generally" and "high-pressure" as well as lacking antecedent basis for "the angle of vertex," claims 23 and 24 have been amended to delete the term "generally" from the claims, to recite "pressurized" in place of "high-pressure" and to recite that the conical shape "has a vertex angle that is..."

Further, claim 24 has been rejected as failing to define any method steps, and such claim has been amended to recite a method including affirmative method steps of "providing" a specified abrasive manufacturing device, "causing said molten metal to eject from the ejecting nozzle" and "ejecting said pressurized fluid onto the molten metal ejected from the ejecting nozzle to surround and powder the molten metal, thereby forming said abrasive."

Accordingly, the objection to claim 11 under 37 CFR 1.75(c) and the various §112 rejections are fully overcome. No new matter (35 USC 132) has been introduced, and all amendatory changes are fully consistent with and supported by the disclosure of the application.

Further, the claims as amended herein overcome the various 35 USC 103(a) rejections of the claims, for the reasons set forth hereinafter.

The §103(a) Rejections of Claims 1-41, and Traversal Thereof

In the June 23, 2005 Office Action, the Examiner rejected claims 1-11, 23 and 24 on reference grounds, including:

a rejection of Claims 1-8, 11 and 23-24 under 35 U.S.C. §103(a) as being obvious over Bergkvist in view of Achikita et al.;

a rejection of Claims 1-8, 11 and 23-34 under 35 U.S.C. §103(a) as being obvious over DE 19815087 in view of Tanaka et al.;

a rejection of Claims 1-11 and 23-24 under 35 U.S.C. §103(a) as being obvious over JP2002-256255 in view of Bergkvist;

a rejection of Claims 1-11 and 23-24 under 35 U.S.C. §103(a) as being obvious over JP2001-0009727 in view of Magnusson et al. and Bergkvist;

a rejection of Claims 1-8, 11 and 23-24 under 35 U.S.C. §103(a) as being obvious over either (1) JP2002-114968 or (2) JP2001-122644 both in view of Bergkvist;

a rejection of Claims 9-10 under 35 U.S.C. §103(a) as being obvious over DE19815087 in view of Tanaka, et al, as applied to Claim 1, further in view of either (1) JP2002-256255, (2) JP2001-009727 or (3) Kydd; and

a rejection of Claims 9-10 under 35 U.S.C. §103(a) as being obvious over either (1) JP2002-114968 or (2) JP2001-122644 both in view of Bergkvist as applied to Claim 1, further in view of either (1) JP2002-256255, (2) JP2001-009727 or (3) Kydd.

These rejections are traversed.

Reconsideration of the patentability of claims 1-11, 23 and 24 is requested, based on the following remarks.

Patentability of Claims 1-11, 23 and 24 over the Reference Combinations Applied in the §103 Rejections of Such Claims

Applicant's claimed invention, as broadly recited in amended independent claim 1 requires an abrasive composition that includes "an inorganic metal powder that contains at least one of boron, aluminum and titanium, ... with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%."

Since claims 2-11 depend directly or indirectly from claim 1, such claims also require "an inorganic metal powder that contains at least one of boron, aluminum and titanium... with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%."

The remaining independent claims 23 and 24 likewise recite compositions containing at least one of boron, aluminum and titanium, subject to the same proviso concerning titanium.

No such composition is taught or suggested by the combinations of references that have variously been asserted against applicant's claims.

The rejection of claims 1-8, 11 and 23-24 under 35 U.S.C. §103(a) as being obvious over Bergkvist in view of Achikita et al.

The primary Bergkvist reference describes warm compacting of stainless steel powders having very low oxygen (<below 0.20 wt%), low silicon (< ~0.5 wt%) and carbon contents (<0.03 wt.%). Specifically disclosed compositions of Bergkvist include powder compositions containing, by

weight %, 10-30% of chromium, 0-5% of molybdenum, 0-15% of nickel, 0-0.5% of silicon, 0-1.5% of manganese, 0-2% of niobium, 0-2% of titanium, 0-2% of vanadium, 0-5% of Fe_3P , 0-0.4% graphite and at most 0.3% of inevitable impurities, and essentially no nickel or alternatively 7-10% of nickel. A lubricant, such as metal stearates, paraffins, waxes, natural and synthetic fat derivatives, and polyamides, may be added to the composition in amounts between 0.1 and 2.0% by weight of the total composition. Bergkvist has been cited for teaching stainless steel powder having a chromium content of 10-30%, in which titanium can be present in an amount of 0-2%.

Achikita et al. describes an injection molding composition composed of a sinterable powder comprising at least one metal or alloy and a binder containing from 10 to 80% by weight of a low-density polyethylene, from 10 to 80% by weight of a paraffin wax and from 5 to 35% by weight of a boric acid ester (e.g., triglycol diborates, trialkyl borates, glycerol borates and alkyl diborates), with the ratio of the sinterable powder to the binder in the composition being from 30 to 70% by volume of the former and from 70 to 30% by volume of the latter. The sinterable powder is a powder of at least one selected from pure iron, stainless steel, carbonyl iron and pure cobalt. Achikita et al. has been cited for teaching "that powders generally have the claimed size" (page 5, lines 5-6 of the June 23, 2005 Office Action).

Concerning this rejection, the examiner has acknowledged that Bergkvist "does not make any mention of boron or aluminum (titanium can be present in an amount of 0-2%) in the stainless steel," Bergkvist's compositions are expressly stated to be low silicon (less than about 0.5% Si) in character, and Achikita et al.'s boric acid ester is an organic boron compound.

Accordingly, the combination of Bergkvist in view of Achikita et al. contains no derivative basis for applicant's claimed invention of "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium, ...with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%," as recited in claim 1, from which claims 2-8 and 11 depend, and as analogously recited in claims 23 and 24.

Claims 1-8, 11 and 23-24 therefore are patentably distinguished over the combination of Bergkvist in view of Achikita et al.

The rejection of Claims 1-8, 11 and 23-34 under 35 U.S.C. §103(a) as being obvious over DE 19815087 in view of Tanaka et al.

The primary reference DE19815087 describes a stainless steel blasting grit comprising angular fragments of a stainless steel-chromium-carbon alloy having a hardness of at least 60 HRC, and containing at least 2 % carbon and 22-32% chromium. This reference has been cited for teaching of a blasting grit containing stainless steel having a chromium content of 10-30%.

The secondary reference Tanaka et al. discloses a blasting medium which has an average grain size of at most 20 µm and contains at least 90 mass % of a water-soluble inorganic salt, wherein the content of grains having grain sizes of at least 50 µm is at most 5 mass %. The blasting medium contains at least 90% of a water-soluble inorganic salt, preferably sodium hydrogencarbonate and/or potassium hydrogencarbonate, and an anti-caking agent having an average particle size of at most 20 µm, e.g., fumed silica or white carbon. Tanaka et al. has been cited as teaching "that blasting medium generally have the claimed size" (page 6, lines 14-15 of the June 23, 2005 Office Action).

Concerning this rejection, the examiner has acknowledged that DE19815087 "does not make any mention of boron, aluminum or titanium in the stainless steel," and Tanaka et al. likewise contains no disclosure or suggestion of such components of boron, aluminum or titanium.

Accordingly, the combination of DE19815087 in view of Tanaka et al. contains no derivative basis for applicant's claimed invention of "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium," as recited in claim 1, from which claims 2-8 and 11 depend, and as analogously recited in claims 23 and 24.

Claims 1-8, 11 and 23-24 therefore are patentably distinguished over the combination of DE19815087 in view of Tanaka et al.

The rejection of Claims 1-11 and 23-24 under 35 U.S.C. §103(a) as being obvious over JP2002-256255 in view of Bergkvist

The primary reference JP2002-256255 describes a coagulation- and agglomeration-resistant polishing material that overcomes water-related problems, in which surfaces of spherical inorganic

particles are treated with a water-repellency-imparting substance. JP2002-256255 has been cited as teaching an abrasive comprising stainless steel that can have the claimed size, in which the abrasive is surface treated with a material that provides water resistance (page 7, lines 16-20 of the June 23, 2005 Office Action).

Concerning this rejection, the examiner has acknowledged that JP2002-256255 "does not make any mention of boron, aluminum or titanium in the stainless steel," and as previously noted the examiner has acknowledged that Bergkvist "does not make any mention of boron or aluminum (titanium can be present in an amount of 0-2%) in the stainless steel," it being additionally noted that Bergkvist's compositions are expressly stated to be low silicon, less than about 0.5% Si.

Accordingly, the combination of JP2002-256255 in view of Bergkvist contains no derivative basis for applicant's claimed invention of "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium, ...with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%," as recited in claim 1, from which claims 2-11 depend, and as analogously recited in claims 23 and 24.

Claims 1-11 and 23-24 therefore are patentably distinguished over the combination of JP2002-256255 in view of Bergkvist.

The rejection of Claims 1-11 and 23-24 under 35 U.S.C. §103(a) as being obvious over JP2001-0009727 in view of Magnusson et al. and Bergkvist

The primary reference JP2001-0009727 describes an abrasive blasting composition composed of inorganic particle powder and meeting all the following conditions (1) to (5):

- (1) $10 \leq A \leq 0.8C$
- (2) $0.03C \leq B \leq 0.5C$
- (3) $50 \leq C \leq 800$
- (4) $30 \leq D \leq 95$
- (5) $E_2 - 3.5 \leq E_1 \leq E_2 - 0.5$

wherein:

- A: maximum particle size (μm) of the abrasive
- B: average particle diameter (μm) of the abrasive
- C: partition width d_1 + ground groove width d_2 (μm) at processing pitch
- D: an index (%) representing indeterminate forms of particles and indicating an area ratio of a particle projected area to a circumcircle
- E₁: Mohs hardness of the abrasive
- E₂: lower Mohs hardness of either the substrate or an electrode

JP2001-0009727 discloses that the abrasive can be any inorganic particle powder, natural or synthetic, e.g., natural inorganic particle powders such as limestone, barite and gypsum, and synthetic inorganic particle powders such as calcium carbonate, barium sulfate and calcium sulfate.

JP2001-0009727 has been cited as teaching an abrasive that can have the claimed size and comprises a material having a Mohs hardness defined by sections [0026]-[0027] of the reference, in which the abrasive is surface treated with a material that provides water resistance in an amount of 0.01-5%.

The secondary reference Magnusson describes a connector structure for separably connecting optical fibers including a pair of precision sleeves, each of which is adapted to surround one of the fibers such that the ends thereof are in axial alignment, and has been cited for disclosure at column 9, lines 53-54 of a Mohs hardness of 5.7 for stainless steel.

Bergkvist has previously been discussed.

Neither JP2001-0009727 nor Magnusson discloses or suggests boron, aluminum or titanium in an abrasive composition, and as previously noted the examiner has acknowledged that Bergkvist "does not make any mention of boron or aluminum (titanium can be present in an amount of 0-2%) in the stainless steel," it being additionally noted that Bergkvist's compositions are expressly stated to be low silicon, less than about 0.5% Si.

Accordingly, the combination of JP2001-0009727 in view of Magnusson and Bergkvist contains no derivative basis for applicant's claimed invention of "[a]n abrasive composed of an inorganic metal

powder that contains at least one of boron, aluminum and titanium, ...with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%," as recited in claim 1, from which claims 2-11 depend, and as analogously recited in claims 23 and 24.

Claims 1-11 and 23-24 therefore are patentably distinguished over the combination of JP2001-0009727 in view of Magnusson and Bergkvist.

The rejection of Claims 1-8, 11 and 23-24 under 35 U.S.C. §103(a) as being obvious over either (1) JP2002-114968 or (2) JP2001-122644 both in view of Bergkvist

The primary reference JP2002-114968 describes an abrasive having an average particle diameter in a range of $1 \leq d_{50} \leq 80$, a dispersion coefficient in a range of $1 \leq d_x \leq 80$, a particle diameter sharpness in a range of $1 \leq d_{50}/d_x \leq 5$, a Morse hardness 1-12 in a range of $0 \leq (d_{90}-d_{10})/d_{50} \leq 10$, and a magnetism in a range of $10 \leq d_{max} \leq 200$, wherein the abrasive comprises stainless steel. JP2002-114968 has been cited for teaching an abrasive that can have the claimed size and comprises stainless steel (page 10, penultimate paragraph in the June 23, 2005 Office Action).

The other primary reference JP2001-122644 describes an abrasive that contains not less than 90% metal powder, wherein the abrasive comprises stainless steel. JP2001-122644 has been cited for teaching an abrasive of the claimed size that comprises stainless steel (page 10, last paragraph in the June 23, 2005 Office Action).

Bergkvist has been considered hereinabove.

Concerning this rejection, the examiner has acknowledged that each of JP2002-114968 and JP2001-122644 "does not make any mention of boron, aluminum or titanium in the stainless steel," and as previously noted the examiner has acknowledged that Bergkvist "does not make any mention of boron or aluminum (titanium can be present in an amount of 0-2%) in the stainless steel," it being additionally noted that Bergkvist's compositions are expressly stated to be low silicon, less than about 0.5% Si.

Accordingly, the combination of JP2002-114968 or JP2001-122644 both in view of Bergkvist contains no derivative basis for applicant's claimed invention of "[a]n abrasive composed of an

inorganic metal powder that contains at least one of boron, aluminum and titanium, ...with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%," as recited in claim 1, from which claims 2-8 and 11 depend, and as analogously recited in claims 23 and 24.

Claims 1-8, 11 and 23-24 therefore are patentably distinguished over the combination of JP2002-114968 or JP2001-122644 both in view of Bergkvist.

The rejection of Claims 9-10 under 35 U.S.C. §103(a) as being obvious over DE19815087 in view of Tanaka, et al, as applied to Claim 1, further in view of either (1) JP2002-256255, (2) JP2001-009727 or (3) Kydd

Each of the rejected claims 9 and 10 is dependent from amended claim 1.

DE19815087 has been considered above, and the examiner has acknowledged that it "does not make any mention of boron, aluminum or titanium in the stainless steel," and Tanaka et al. likewise contains no disclosure or suggestion of such components of boron, aluminum or titanium.

Tanaka et al. likewise has been considered hereinabove and contains no disclosure or suggestion of such components of boron, aluminum or titanium.

The teachings of JP2002-256255 have been described above and the examiner has acknowledged that JP2002-256255 "does not make any mention of boron, aluminum or titanium in the stainless steel." JP2001-009727 has also been discussed above, and likewise does not disclose or suggest boron, aluminum or titanium in an abrasive composition.

Kydd discloses a mixture of metal powders and metallo-organic decomposition (MOD) compounds in an organic liquid vehicle. The metal can be any of copper, silver, gold, zinc, cadmium, palladium, iridium, ruthenium, osmium, rhodium, platinum, iron, cobalt and nickel, (Groups Ib, IIb and VIII), and indium, tin, antimony, lead and bismuth. Kydd has been cited for teaching at column 8, line 66-column 9, line 6 of surface treating metal particles with stearic acid in order to prevent agglomeration (page 12, lines 8-11 of the June 23, 2005 Office Action).

Kydd's organic vehicle/organometal/metal compositions are not in any way disclosive or suggestive of applicant's claimed invention of "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium," as recited in claim 1, and therefore likewise required in claims 9 and 10, each of which depends from claim 1.

For a *prima facie* case of obviousness to be presented, the prior art reference(s) must teach all of the limitations of the claims. MPEP §2143.03.

Since none of DE19815087, Tanaka, et al, JP2002-256255, JP2001-009727 or Kydd teach "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium," the references fail to teach all of the limitations of claims 9 and 10, and such claims 9 and 10 therefore are fully patentable over the combination of such references.

The rejection of Claims 9-10 under 35 U.S.C. §103(a) as being obvious over either (1) JP2002-114968 or (2) JP2001-122644 both in view of Bergkvist as applied to Claim 1, further in view of either (1) JP2002-256255, (2) JP2001-009727 or (3) Kydd

All of the variously cited references have been discussed hereinabove.

Concerning this rejection, the examiner has acknowledged that each of JP2002-114968 and JP2001-122644 "does not make any mention of boron, aluminum or titanium in the stainless steel," and as previously noted the examiner has acknowledged that Bergkvist "does not make any mention of boron or aluminum (titanium can be present in an amount of 0-2%) in the stainless steel," it being additionally noted that Bergkvist's compositions are expressly stated to be low silicon, less than about 0.5% Si.

The teachings of JP2002-256255 have been described above and the examiner has acknowledged that JP2002-256255 "does not make any mention of boron, aluminum or titanium in the stainless steel."

JP2001-009727 has also been discussed above, and likewise does not disclose or suggest boron, aluminum or titanium in an abrasive composition.

As noted above, Kydd's organic vehicle/organometal/metal compositions are not in any way disclosive or suggestive of applicant's claimed invention of "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium," as recited in claim 1, and therefore likewise required in claims 9 and 10, each of which depends from claim 1.

Accordingly, the combination of JP2002-114968 or JP2001-122644 both in view of Bergkvist as applied to claim 1, further in view of either JP2002-256255, JP2001-009727 or Kydd, contains no derivative basis for applicant's claimed invention of "[a]n abrasive composed of an inorganic metal powder that contains at least one of boron, aluminum and titanium, ...with the proviso that when the inorganic metal powder contains titanium in the absence of boron and aluminum, the inorganic metal powder further contains silicon in an amount of at least 0.7 wt%," as recited in claim 1, from which claims 9 and 10 depend.

Claims 9 and 10 therefore are patentably distinguished over such combination of references.

Based on the foregoing, claims 1-11, 23 and 24 are fully patentable over the references, and otherwise in form and condition for allowance.

Favorable action is respectfully requested.

If any issues remain outstanding, incident to the formal allowance of the application, the Examiner is requested to contact the undersigned attorney at (919) 419-9350 to discuss same, in order that this application may be allowed and passed to issue at an early date.

Respectfully submitted,



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The Office is hereby authorized to charge any fees determined to be properly payable for entry of this Response, to Deposit Account 08-3284 of Intellectual Property/ Technology Law.